

PLASTERER'S
MANUAL

PORTLAND CEMENT ASSOCIATION

PLASTERER'S MANUAL

Concrete for Permanence

PORTLAND CEMENT ASSOCIATION

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An Old Timer Speaks



John H. Donlin, editor of "The Plasterer."

"By one who has nothing but the welfare of our craft at heart, this earnest plea is made—find out what good stucco work really means—assure yourself that right materials are used in all coats to make permanent the beauty of the finish—take advantage of opportunities to learn how to create beautiful colored and textured effects—in short, *be a craftsman as well as a plasterer!*"

"There is an appreciation of the beauty in colored and textured walls today that will greatly increase the scope of the plasterer's work if he will but realize his opportunity and equip himself to do such work.

"Craftsmanship determines the beauty of a stucco finish. It requires considerable artistry to develop new and attractive textures and combinations of colors that will harmonize with other materials, with the architectural style of the building, and with the setting in which it is placed.

"The building industry looks to the plasterer to create this beauty in plastic materials by methods which will insure permanent results. It has put the question squarely to him to decide whether he will accept this commission or allow other artisans and other materials to usurp his place and his work."

John H. Donlin

FOREWORD

PLASTERING is one of the oldest arts. Its purpose in early days was that of filling the cracks in walls to make them weather-tight. The "wattle and daub" or mud plastering of the ancient Briton is an example of this early use of plaster.

With the development of the art, portland cement stucco, a highly durable plastering material, came into wide use. As its decorative possibilities became better known there developed a popular demand for new and unusual effects. To produce these, plastering materials of better spreading quality were required. This led to the use of large amounts of admixtures.

Plasterers soon learned that materials having extreme spreading qualities usually were less durable. To correct this it was necessary to develop a product that would endure yet be plastic enough to permit a wide range of artistic finishes. Experiments with portland cement stucco on the scaffold and in the laboratory have provided a wall covering which satisfies both the requirements of durability and satisfactory appearance.

Facts brought out in these experiments furnish the basis for this manual which presents latest practices in the use of portland cement stucco and plaster. These products have the natural qualities of portland cement concrete, the age-old building material. They are durable—age increases their strength and density. They do not cause colors to fade nor metals to rust. They resist fire. They have sufficient plasticity and harden slowly enough to let workmen produce a variety of textures. All these desirable qualities are obtained at moderate cost.

To increase the value of this manual as a reference and guide, the material is presented in three sections: (1) Portland Cement Stucco, (2) Portland Cement Plaster, and (3) Construction Details. The term "stucco" refers to outside work and the term "plaster" to inside work.

SECTION I

PORTLAND CEMENT STUCCO

Materials

The principal materials in portland cement stucco are portland cement, aggregate and water. Other materials are added as required, such as (1) mineral pigments for producing colored finish coats, (2) hair or fiber for use in the scratch coat mortar on back-plastered construction, and (3) plasticity materials when increased workability is desired.

Portland Cement

Portland cement should meet the present requirements of the American Society for Testing Materials. (All the standard brands of portland cement made in America meet these requirements.)

Aggregate

Aggregate should be clean sand, screenings from crushed stone, or a mixture of these properly graded from fine to coarse. All aggregate for the base coats (scratch and brown) should pass the No. 8 sieve with approximately 5 per cent passing the 100-mesh sieve. For the finish coat the fineness limit remains the same but it may be desirable to have less coarse material. The exact grading is governed by the type of finish desired. For some finishes the aggregate is limited to material passing the No. 14 sieve, while for others requiring less plasticity, materials that have up to 15 per cent retained on the No. 14 sieve are suitable. All aggregate must be free from loam, silt and vegetable matter.

Sand may be tested for silt as follows. Pour sand into a 32-ounce graduated bottle to the level of the 14-ounce mark and add water to the 28-ounce mark. Shake vigorously for a minute and allow to settle for one hour. If one ounce or more of sediment appears above the sand it is not suitable for use in stucco.

Here is a simple test to find out if the sand contains vegetable matter. An ordinary 12-ounce prescription bottle is filled to the $4\frac{1}{2}$ -ounce mark with a sample of the sand. A 3 per cent solution of caustic soda* (sodium hydroxide) is added until the 7-ounce mark is reached. The contents are shaken thoroughly and then allowed to stand 24 hours. The color of the liquid will indicate whether the sand contains dangerous amounts of vegetable matter. A clear or light-colored liquid shows the absence of vegetable matter. A light straw color shows the presence of

*A 3 per cent solution of caustic soda may be made by dissolving one ounce of sodium hydroxide in a quart of water. Keep the solution in a glass bottle tightly corked. Handling sodium hydroxide with moist hands may result in serious burns. It is also injurious to clothing and leather. Any druggist can make the correct solution for you.



Unusual charm in residential construction is secured through the combination of stucco with other building materials. The cast stone door and window trimmings in this residence accentuate the beauty of finish and design.

some organic matter but not enough to be harmful. Dark color means the sand contains injurious amounts and should not be used.

Plasticity Agents

Materials passing the 100-mesh sieve (excepting cement) are referred to as "plasticity agents," "lubricators" or "fatteners," and are used to increase workability. Aggregate material passing the 100-mesh sieve, hydrated lime, diatomaceous earths, finely divided clays, and asbestos fiber are common plasticity agents. These materials should be of the highest quality and should not be added in excess of the amounts given in the section on "Proportioning and Mixing," page 15. Excessive amounts are objectionable in that they reduce strength and increase porosity.

Water

Only water that is fit to drink should be used in mixing stucco. It should be free from oil, acid, alkali and vegetable matter.

Mineral Pigments

Only high-grade mineral pigments should be used for coloring stucco. Such pigments have the highest color values and are most economical since less pigment is required to produce a desired effect. Aniline base colors and other organic or vegetable dyes should not be used as they are likely to fade.

Mixing of pigments in finish coat materials should be resorted to on the job only when factory made portland cement stucco is not available.

In a factory-made product, pigments and cement are first ground together and then mixed thoroughly with the aggregate in special machine mixers. It is possible under these conditions to attain accuracy in measurement and thoroughness in mixing which ordinarily cannot be approached on the job.

In the event that factory-made portland cement stucco is not available, the use of colored cement, a commercial product obtainable in most markets, will be found best. With colored cement the difficult operation of mixing the pigments and the cement on the job is eliminated. If colored cement is not obtainable, then it will be necessary to mix the cement and mineral pigment on the job, in which case it is recommended that a ball mill be used for the purpose. A general guide for the selection of color is given below. Correct proportions of cement and pigment are determined by trial as explained on page 15.

Coloring Materials

A general guide for the selection of coloring materials follows:

For *brown*, use burnt umber or brown oxide of iron. Yellow oxide of iron may be added to obtain modification of this color.

For *buff*, use yellow ochre or yellow oxide of iron. Red oxide of iron may be added in limited quantities.

For *gray*, use small quantities of black iron oxide, manganese black or Germantown lampblack.

For *green*, use chromium oxide. Yellow oxide of iron may be added.

For *pink*, use small quantity of red oxide of iron.

For *rose*, use red oxide of iron.

For *cream*, use yellow oxide of iron in small quantities.

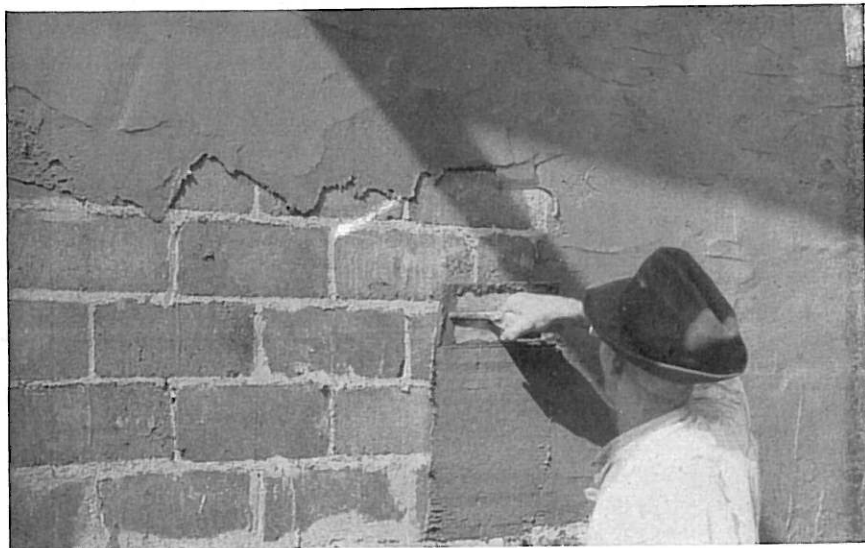
For *white*, use white portland cement.

Bases for Portland Cement Stucco

Success in the application of portland cement stucco requires that it be used either (1) as a material that is bonded to and becomes an integral part of the base to which it is applied, such as stucco on masonry, or (2) as a thin reinforced concrete slab anchored to the structure but not itself forming an integral part of the backing. An example of the latter is stucco applied on metal reinforcement over frame structures.

Masonry Walls as a Stucco Base

Walls of concrete masonry, hard-burned clay tile and hard or medium clay brick are excellent bases for the direct application of portland cement stucco. The surfaces of these units should be rough to



Scratch coat is applied directly to masonry walls having a coarse texture.

provide good mechanical key and should be free from paint, oil, dust, dirt, soot, or any other material that might interfere with satisfactory bond.

Portland cement mortar should always be used in laying up masonry walls that are to be stuccoed. Joints may be struck off flush or slightly raked.

Old masonry walls when softened by weathering, surfaces that cannot be cleaned thoroughly such as painted brickwork, and all chimneys, will require a covering of metal reinforcement before applying stucco. See section on "Metal Reinforcement," page 10.

Monolithic Concrete

Monolithic concrete walls that have coarse or roughened surfaces are suitable bases for direct application of portland cement stucco. When the surfaces are not rough enough to provide anchorage, it is necessary to prepare them as follows:

- (1) Old monolithic concrete walls should be roughened with bush-hammers or other special tools, and then washed thoroughly with water to remove all dirt and loose particles.

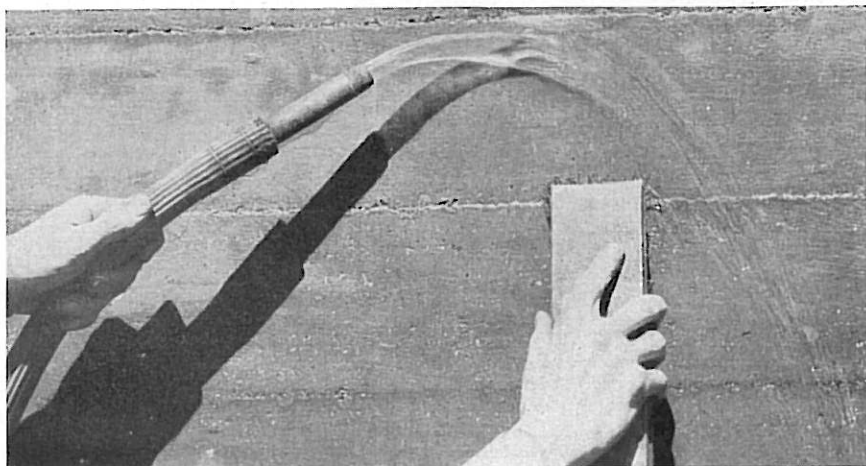
- (2) Acid-washing, using a solution of 1 part muriatic acid to 6 parts water, is another method of preparing old concrete surfaces to receive stucco. First the wall should be wetted with water so that the acid will act on the surface only. More than one application of acid may be

necessary. After this treatment the wall must be washed thoroughly with water to remove all traces of the acid. If the wall is not roughened sufficiently by the acid it will be necessary to use bush-hammers as mentioned in the preceding paragraph.

(3) New monolithic concrete can be roughened with a heavy wire brush or a special scoring tool if forms are removed early. In such cases care must be taken not to remove forms before the concrete is hard enough to be self-sustaining. Forms for concrete that is to receive stucco should not be given oil or soap coatings, as these are likely to remain on the concrete, interfering with bond. Oil on the surface of concrete can be removed by washing with soap and water.

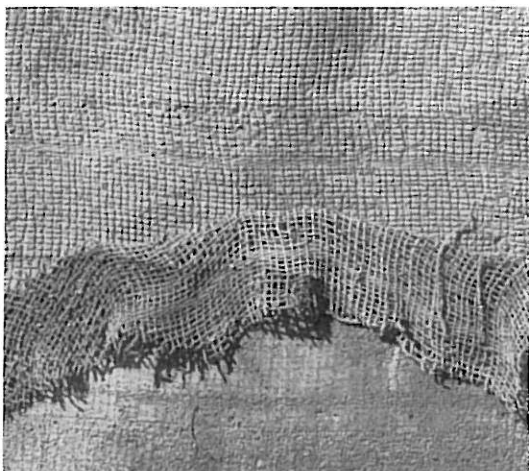


Acid-washing monolithic concrete will improve the bond between the dash coat and the concrete surface. The acid is being applied with a scrubbing brush.



Washing a monolithic concrete wall after acid treatment.

(4) Another method of providing rough surfaces on monolithic concrete is by the use of a special large-mesh patented burlap placed on form faces. After forms are removed the burlap is stripped off the concrete, leaving a deeply scored surface.



Showing the rough surface produced on monolithic concrete by the use of special burlap.

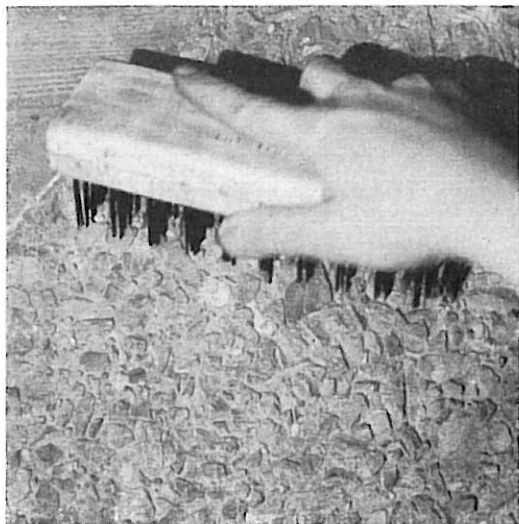
(5) Monolithic surfaces also can be roughened through the use of special compounds painted on the form faces.

These retard hardening of the surface concrete. The desired roughness is secured by brushing off the surface material after forms are removed.

Metal Reinforcement

Metal reinforcement must be used for stucco applied on wood or steel

frame structures of the open or sheathed type, on masonry structures that do not provide satisfactory bond, for example, chimneys and disintegrating surfaces, and on old stucco surfaces which are to be refinished. (See section on "Refinishing Old Stucco Jobs," on page 18.) Metal reinforcement also must be employed wherever stucco is to be carried over flashing.



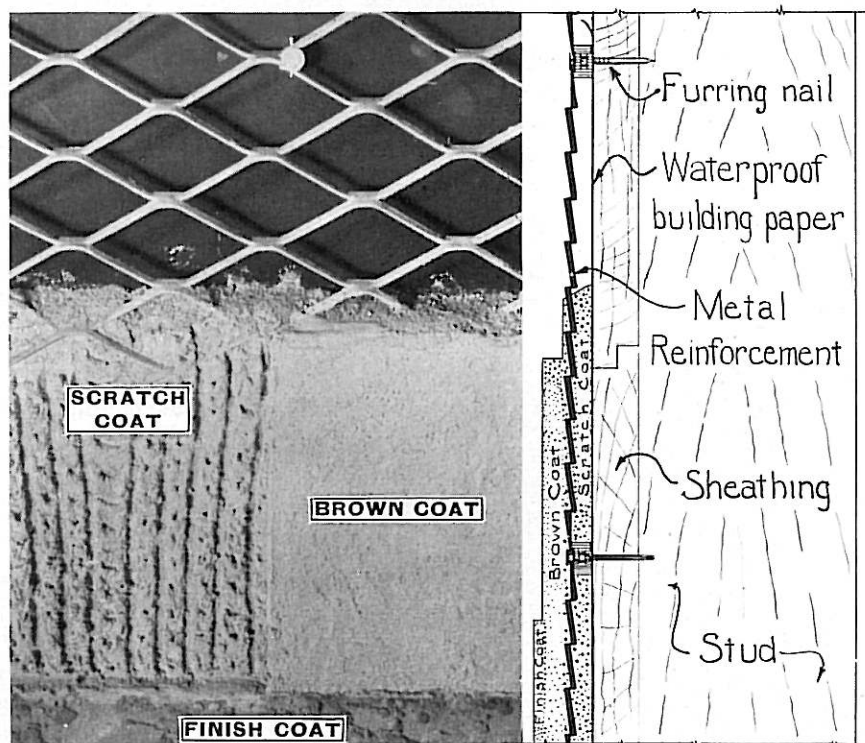
Another method of preparing monolithic concrete to receive stucco. A special compound painted on the forms retards hardening in the surface concrete, permitting the aggregate to be exposed by brushing.

Structures to receive stucco on metal reinforcement should be well braced and rigid. Studs

in sheathed construction should be not more than 16 inches on centers, tied together below floor joists and bridged at least once every story height. Diagonal bracing at all corners, let into studs, is recommended to give additional rigidity. Sheathing should be placed horizontally and well nailed on each stud. In open wood-frame construction, studs should be not over 12 inches on centers and braced rigidly as described for sheathed construction.

Surfaces that are to receive metal reinforcement (excepting areas to be back-plastered) should first be covered with waterproof building paper. On open construction the paper serves as a backing for the scratch coat. In the case of sheathed construction and on those masonry surfaces requiring metal reinforcement it prevents absorption of moisture from the fresh mortar.

The paper is attached with large-headed galvanized nails. Upper strips should overlap lower strips at least 3 inches. Vertical joints



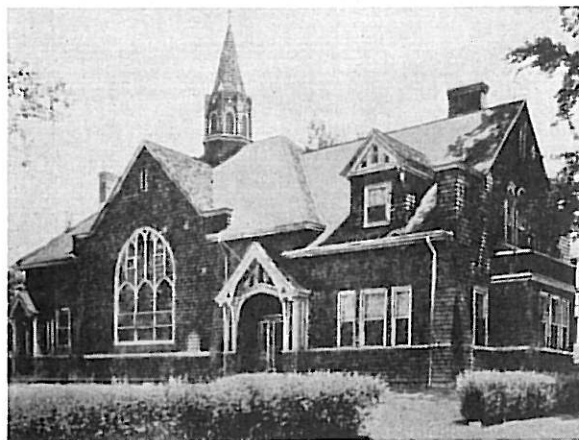
Showing proper construction for stucco on metal reinforcement. Note the backing of waterproof building paper, the metal reinforcement held at least $\frac{3}{8}$ inch away from the backing with furring nails, and the scratch coat filled in solidly behind the metal.

should be lapped at least 6 inches. To support the paper and prevent tearing on open frame construction, wires (usually No. 18 gauge) should be stretched tightly across the faces of the studs in single strands at 6 or 8-inch intervals.

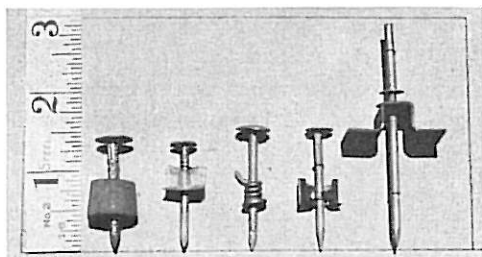
Metal reinforcement should be a large-mesh type of expanded metal or wire fabric. Its minimum net weight should be 1.8 pounds persquare yard or 20 pounds per 100 square feet. For some jobs, a heavier product is desirable. The openings should be not smaller than $\frac{3}{4}$ inch square nor larger than 2 inches square. For back-plastered construction, metal lath or wire lath weighing 3.4 pounds per square yard is recommended.

Large openings in the reinforcement are desirable so that the mortar will be pushed through to the backing, completely embedding the metal. Where there is no backing, as in work to be back-plastered, reinforcement of relatively small mesh (metal lath or wire lath) is necessary. Complete coverage of the metal in the latter case is secured when the back-plaster coat is applied.

The reinforcement must be securely attached. It should be furred at least $\frac{3}{8}$ inch from the face of the wall or studs so that stucco can be forced behind the metal. Furring nails or other furring devices that will not reduce the effective thickness of the stucco should be used. See illustration. Furring strips are objectionable as they make planes of weakness in the stuccoslab and cracking may result.



Before overcoating.



Several types of furring nails—to accommodate practically any of the types of stucco reinforcement available.

Reinforcement should form a continuous network of metal over the entire surface. All laps

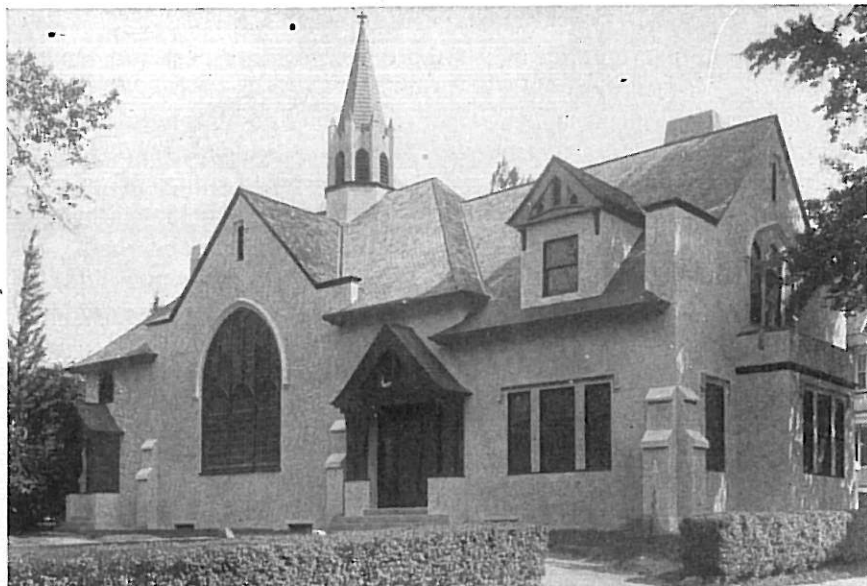
should be at least one mesh wide and securely wired. Butt-joints should not be used unless special care is taken to lace the sheets together securely. Sheets of reinforcement should be returned around corners at least one stud spacing on open-frame construction and at least 4 inches on other types of construction.

Overcoating

There is a growing demand for portland cement stucco for the overcoating of old houses. Any loose siding on old frame buildings to be "overcoated" should be securely renailed. All woodwork and trim should be built out to provide sufficient projection and proper drips. Waterproof paper and metal reinforcement must be applied as described in the preceding paragraphs on "Metal Reinforcement."

Suction

Every plasterer knows what suction is. He also knows how difficult it is to describe exactly the degree of suction required for different conditions. There is a certain "feel" that tells him when suction is right. Suction is absolutely necessary where stucco is to be applied directly to masonry or monolithic concrete bases in order to get the proper bond. It is also necessary in the first and second coats so that succeeding coats will be properly bonded.



After modernizing with portland cement stucco.



A fog spray is recommended for dampening the wall to develop proper suction.

Uniform suction is essential in order to obtain uniform color. If one part of the wall draws more moisture from the freshly applied stucco than another, the finish coat may have a spotted appearance.

Uniform suction is obtained by dampening, but not soaking, the wall evenly before applying the stucco. If the surface becomes dry in spots, these areas should be dampened again to re-

store uniform suction. A fog spray is recommended for this work.

Plasterers should work on the shady side of buildings when possible, as it is difficult to keep walls dampened properly when exposed to the sun. Suction is controlled more easily in the shade.

Curing

To develop maximum strength and density in any portland cement product it is necessary to cure it properly. This is especially true of portland cement stucco, which is really a thin slab of concrete. *Each coat should be kept damp continuously for at least two days.* Moistening should commence as soon as the stucco has hardened sufficiently not to be injured, applying the water in a fine fog spray. Avoid soaking the wall. Give it only as much water as will be readily absorbed. To prevent excessive evaporation on the sunny or windward sides of buildings in hot, dry weather, tarpaulins should be hung over the outside of the stucco and kept moist.

After the damp-curing period, each stucco coat should be allowed to dry thoroughly before the next coat is applied. The practice of doubling coats without a two-day moist-curing period followed by a drying interval is not good construction practice.

When stucco is applied during cold weather, longer curing periods are necessary. In freezing weather it should not be applied unless special methods are employed to keep the materials at a temperature above 50 degrees Fahrenheit for at least 48 hours.

Proportioning and Mixing

Base coats (scratch and brown) should be made of 1 part portland cement and 3 parts aggregate. See page 5 for material specifications. If a plasticity agent is required (see page 6), use not to exceed 10 pounds of hydrated lime per sack of cement. If other lubricators are employed, use smaller amounts (about 2 to 3 pounds). For job-mixed finish coats, approximately the same proportions are used as for the base coats.

Proper proportions of mineral pigments in finish coat stucco should be determined by experiment. In general, the amount of coloring materials should not exceed six per cent of the weight of the cement. White finishes are obtained by using white portland cement and light-colored aggregate. A general guide to the selection of mineral pigments to obtain the various color effects commonly used in portland cement stucco, such as gray, green, buff, brown and others, is given in the table under the heading "Coloring Materials" on page 7.

Measurements of materials must be accurate and all batches proportioned exactly alike. Because variations in the moisture content of the aggregate cause change in volume due to bulking, aggregate of uniform moisture content should be used throughout the job to insure accurate measurements.

Materials should be mixed to a uniform color before water is added and then wet-mixed to the desired consistency. Thorough mixing is absolutely essential. Hand-mixing is satisfactory if done thoroughly, but machine-



The dependability of properly applied portland cement stucco is extending the plasterer's field to include buildings of this type. Thousands of yards of stucco were used in finishing the exterior of the Hollywood Terminal building in Los Angeles.

mixing usually gives greater uniformity. The mixer should be run at least five minutes after all ingredients are placed in the drum. In the case of hand-mixing, the batch should be hoed back and forth in the box ten to fifteen minutes after the water has been added.

Portland cement stucco is not injured by standing $2\frac{1}{2}$ to 3 hours if remixed frequently without adding water. No mortar should be used after it has set up or hardened to such an extent that water must be added to make it workable. Admixtures to hasten set should not be used.

Flashing

Flashing, which is vital to permanent construction, must be so designed and placed that water will not get behind the stucco. Continuous flashing should be placed under all copings, cornices, belt courses and multiple-piece sills to prevent entry of water. Flashing must be a high-grade rust-resisting material. It is folly to use a short-lived metal with so permanent a wall covering as portland cement stucco. See drawings on pages 41 to 47 for flashing details.

Application

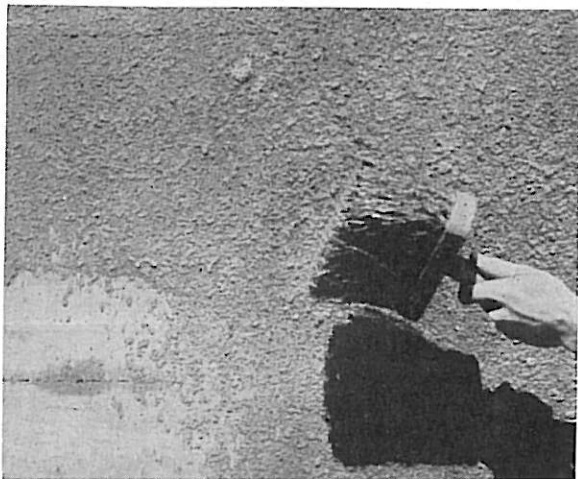
The Scratch Coat

The scratch coat should be approximately $\frac{3}{8}$ inch thick and carried the full length of the wall or to natural breaking points like doors or windows. Before the scratch coat hardens it should be deeply cross-scratched to provide mechanical key for the brown coat.

Masonry walls on which stucco is to be applied directly should be clean and dry, but before applying the scratch coat the surface must be dampened evenly to control suction, an essential practice in securing first-class work. (See page 13.) The scratch coat should be troweled on hard and tight, being forced into surface depressions to obtain a permanent bond.

On monolithic walls, the first coat should be dashed on unless the surface is sufficiently rough to insure adequate bond for the scratch coat when applied with a trowel. Rough surfaces that permit successful application with the trowel are produced by mechanical roughening or through the use of special compounds employed during construction. See page 8. Surfaces treated by acid-washing generally are not rough enough to retain a troweled scratch coat, in which case a dash coat is necessary. Dashing on the first coat aids in securing intimate bond by excluding air which might otherwise be trapped behind the stucco.

The dash coat is applied using a strong whipping motion at right angles to the face of the wall, or it may be applied with a stucco machine or cement gun. In either case it must be projected with considerable force. The mortar should be of a mushy consistency and composed of 1 part portland cement to $1\frac{1}{2}$ parts of aggregate.



Dashing a first coat on monolithic concrete.

The first coat

should be kept damp for at least two days immediately following its application. It should then be allowed to become thoroughly dry.

On metal reinforcement, mortar should completely embed the metal. This is easily accomplished with the large-mesh type of reinforcement, openings being large enough to permit scratch coat mortar to pass through readily. In back-plastered construction using metal lath or wire lath, complete coverage for the metal is assured by the back-plaster coat. This is a $\frac{3}{8}$ -inch coat of mortar applied to the back of the lath after the scratch coat has hardened sufficiently so that pressure will not break the plaster keys.

The Second or "Brown" Coat

Before starting to apply the brown coat, the surface of the scratch coat should be dampened evenly as described under "Suction" on page 13. The brown coat is approximately $\frac{3}{8}$ inch thick. It should be brought to a true, even surface and then roughened with a wood float to provide bond for the finish coat. The brown coat must be damp-cured for at least two days and then allowed to become dry.

The Finish Coat

Before starting to apply the finish coat, the brown coat should be dampened evenly as described under "Suction" on page 13. Whenever possible, textures should be applied from top to bottom in one operation to eliminate joining marks. See pages 20 to 35 for several textures.



Commercial buildings with a combination cast stone and stucco finish are becoming increasingly popular, presenting a large increased market for portland cement stucco.

If the finish coat is a factory made material, manufacturers' directions for application should be followed closely.

Refinishing Old Stucco Jobs

Plasterers may be required to resurface old stucco jobs in order to renew the finish and change the color or texture, or both. This may be done provided the old stucco is in a sound condition. If the original stucco is unsound, it will be necessary to remove the old material entirely and apply a new three-coat job. Where old stucco is not readily removable, as is often the case on masonry backing, it will be necessary to cover the old surface with paper and metal reinforcement and then apply the standard three coats.

Old stucco surfaces when sound are prepared for refinishing as follows:

The entire area is wetted and then cleaned down with a solution of 1 part muriatic acid and 6 parts water. After acid-treating, it should be washed thoroughly with water to remove all traces of the acid and any loose particles.

The wall should be allowed to dry thoroughly and then moistened just prior to application of the new coat to secure uniform suction. On surfaces of coarse or rough texture (as, for example, rough cast work), the new finish may be a single coat applied with the trowel. If the old

surface lacks roughness it will be necessary to apply two coats—the first coat being a dash coat to establish bond. After the dash coat has been properly cured as described on page 14, the finish coat is troweled on.

Portland cement stucco must not be applied directly over lime, gypsum or magnesite stucco. These materials either should be removed entirely or they should be covered first with waterproof paper and metal reinforcement as described on pages 10 to 13. In either case standard three-coat portland cement stucco should be applied.

Causes for Discoloration

The most common causes for discoloration are:

Failure to have uniform suction in either of the base coats. Improper flashing, and corrosion of flashing or metal attachments. (See page 44 for best methods of flashing and bracketing.)

Insufficient mixing of finish coat materials and the use of inferior pigments.

Changes in materials or in proportions during progress of a job.

Variations in amount of mixing water.

Failure to provide drips and washes on sills and projecting trim.

Use of additional water to retemper mortar that has partially set up.



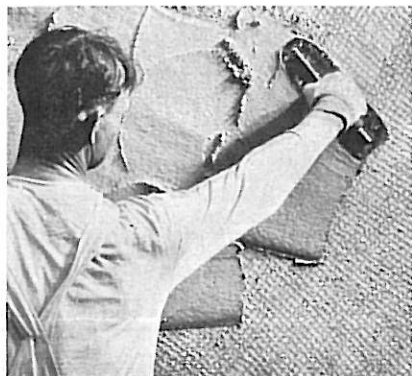
The cast-stone entrance, the stuccoed walls and sweeping roof lines combine to give individuality to this firesafe residence.

SPANISH TEXTURE

THE stucco is applied in fairly heavy layers when creating this texture. A full trowel of mortar is used for each stroke. Strokes of the trowel are made in all directions, being curved and varied to form rolling ridges and hollows in the finished surface. A trowel with rounded corners (Fig. 1) is used so that straight-line markings will not appear in the finish.

Best results are secured with a fairly stiff mortar. Uniform dampening of the brown coat aids in the spread of the finish, helping to make the mortar stand as placed by the trowel. The wall should not be soaked, however, so that water stands on the surface. Before the mortar hardens to a point where it has lost its workability, the rough edges are smoothed out with a round-point trowel. This operation forces projecting sand particles into the mortar, tending to compact the stucco and close the surface pores, yet leaves the wavy effect necessary to a Spanish Texture. Excessive troweling should be avoided.





1. Using a round point trowel



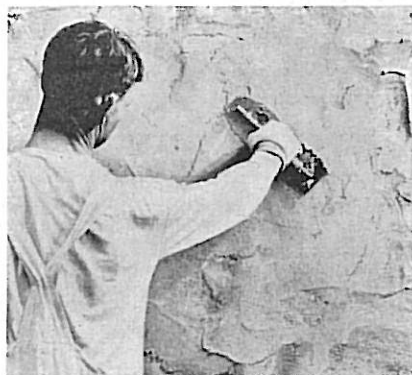
2. Strokes in all directions



3. A left horizontal stroke



4. Irregular overlapping



5. Finishing with the trowel



6. A wavy, trowel-marked finish

CALIFORNIAN TEXTURE

THE mortar for this texture is spread in applications similar to those used in creating the Spanish. Full trowels of mortar are spread in all directions and allowed to remain as placed without additional smoothing. There are no straight-line markings, as a rounded trowel is used and curved strokes are employed.

Before the mortar hardens, its surface is rubbed down with a wadded piece of burlap (Fig. 4) to produce a wavy, irregular surface having a coarse texture.

The final treatment consists of troweling the entire area. This operation creates highlights throughout the surface. These are in contrast to the relatively coarser texture of the deeper areas. Troweling also tends to force sand particles into the mortar, compacting the surface.

The finished appearance is shown in Fig. 6—an effect like that obtained in plastering over an irregular surface, with the added touch of highlights here and there resulting from the final troweling.

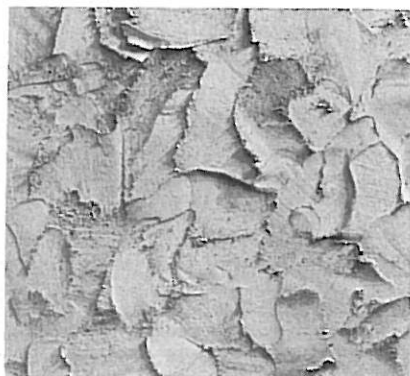




1. Full sweep spreading



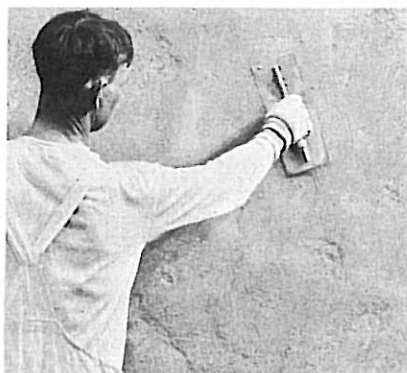
2. Creating the texture



3. Preliminary appearance



4. Rubbing with burlap

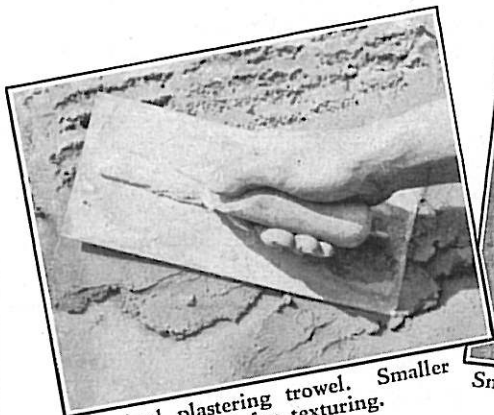


5. Troweling high points

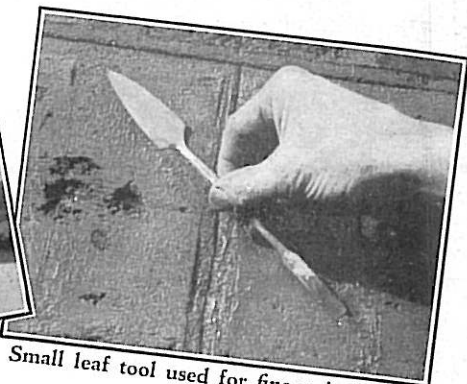


6. A rubbed troweled finish

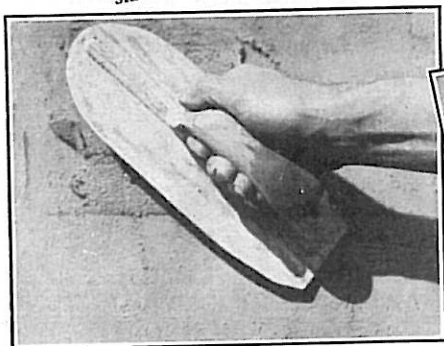
Plastering and



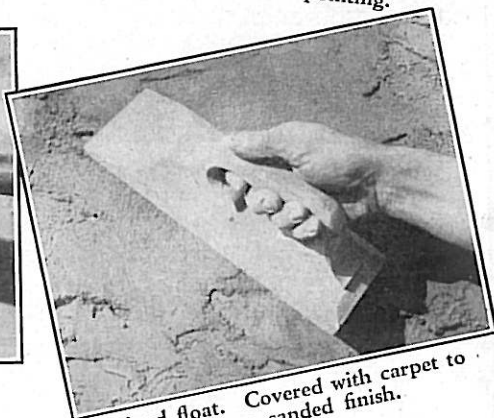
Standard plastering trowel. Smaller size used for texturing.



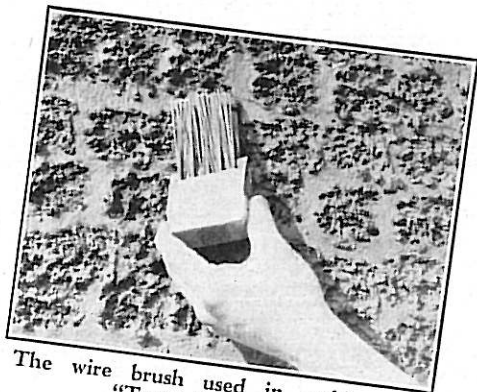
Small leaf tool used for fine pointing.



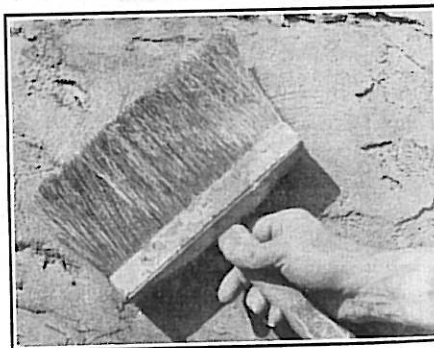
A round point trowel.



Wood float. Covered with carpet to produce sanded finish.



The wire brush used in making the "Travertine" texture.



The Dutch brush used for applying washes or for softening rough textures.

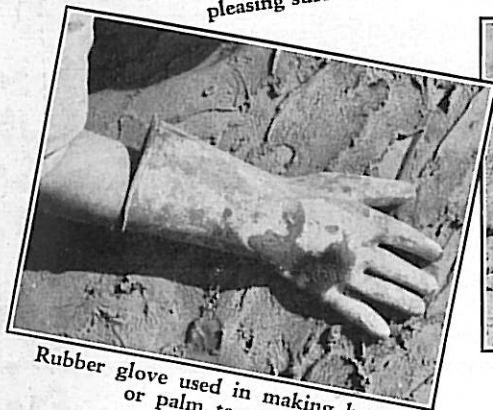
Texturing Tools



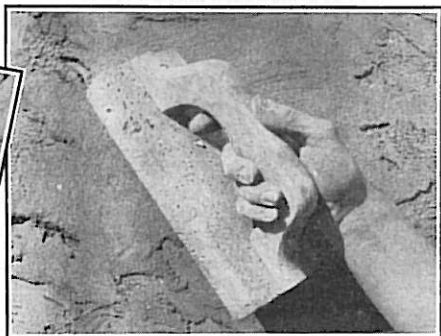
A rubber sponge produces a pleasing surface.



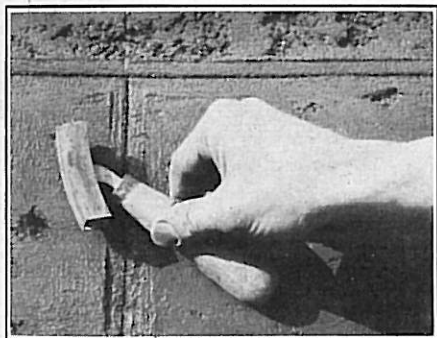
Sheepskin glove used to rub down heavy textures.



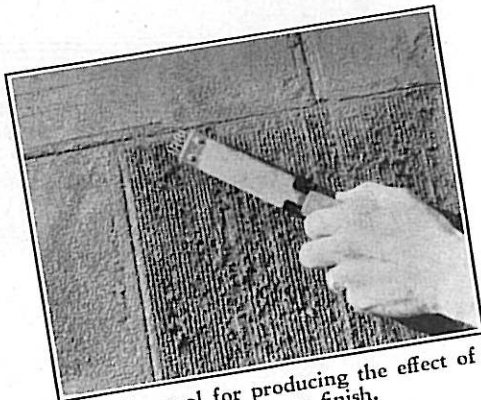
Rubber glove used in making hand or palm textures.



A cork float.



The jointing tool for marking off surfaces to resemble masonry.



Combing tool for producing the effect of a tooled stone finish.

ITALIAN TEXTURE

THIS texture is created with a spatter-dash finish applied on a thin under-coat. The dash coat is troweled to give contrasting smooth and rough areas. Polychrome finish can be secured by using differently colored mortars in the under-coat and the dash.

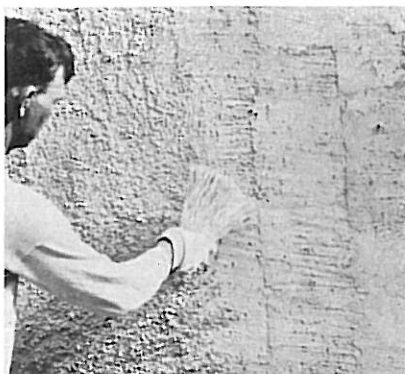
A very thin coat is first troweled on the wall. This insures uniform color over the entire surface, even though the dash coat may not give complete coverage. Then small quantities of mortar are dashed on with quick strokes of a whisk broom. A bundle of reeds may be used for a slightly different effect. Since a spatter-dash coat hardens rapidly, not more than thirty square feet of wall should be covered at a time, and then finished before any hardening occurs.

Finishing is best accomplished by placing the trowel flat against the partially set dash coat and drawing it evenly across the face of the wall from left to right. A smoothing return stroke may be made to erase possible trowel marks. Variations will occur in this texture according to the time elapsing between dashing and troweling. Consequently this time should be constant for uniform appearance. A close-up of the finished appearance is shown in Fig. 6.





1. Applying thin backing coat



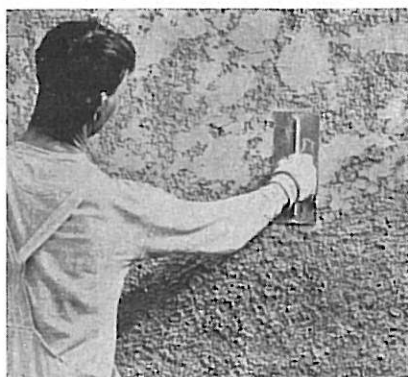
2. Spatter-dash application



3. Method of holding bucket



4. Spatter-dash finish



5. Troweling dashed surface



6. A troweled, spatter-dash finish

ENGLISH COTTAGE

THIS texture is created by feathering the stucco with the edge of the trowel into irregular wavings and surfaces.

A preliminary coat is applied about $\frac{1}{8}$ inch thick. Portions of this coat are left exposed in the finished work and other portions provide plastic surfaces on which to spread additional mortar used for creating the irregular finish. Small amounts of mortar are then applied with the trowel, using short, twisting strokes at varying angles to the wall, avoiding vertical or nearly vertical strokes. By twisting the trowel as the pat of mortar is applied, slightly curved ridges will be formed. (Fig. 3.)

Variations of this texture are obtained by varying the amount of mortar, the directions and length of trowel strokes and the pressure and twisting motion given the trowel. Heavier applications than those used in Fig. 5 are sometimes desirable.

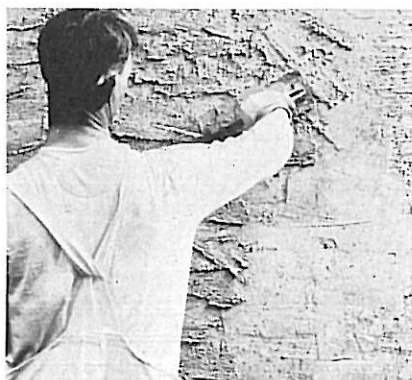




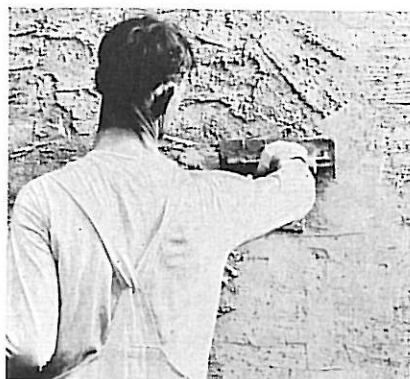
1. Applying thin backing coat



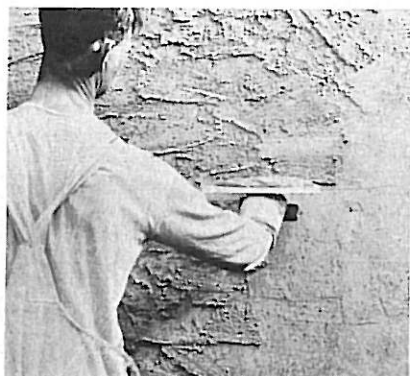
2. Feathering with square trowel



3. Pinched off in all directions



4. Twisting, feathering application



5. Showing small trowel of mortar



6. A fine, leallike finish

COLONIAL TEXTURE

THE colonial is one of the most popular finishes. To assure a regular even surface the brown coat should be finished by rubbing with a wood float in a circular motion, producing an even but comparatively coarse texture.

The mortar for the finish is applied in a very thin tight coat. This is allowed to stand until hardened sufficiently to permit working without rubbing off or bunching. Then the surface is rubbed with a carpet float, using a circular motion which produces an evenly sanded finish. As it is being floated the surface may have to be moistened occasionally. This sand-floated finish, devoid of textural ornamentation, is of sufficient body to hold the lighting tones thrown upon it. The lighter tints, such as white, ivory, buff or occasionally a pale cream yellow, are more in keeping with this texture.





1. Applying browning coat



2. Floating browning coat



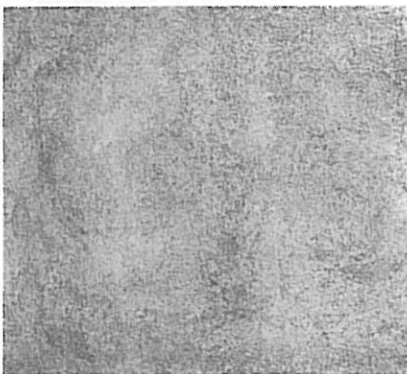
3. Applying finishing coat



4. Wetting with brush



5. Carpet floating



6. A smooth, sand-floated surface

MODERN AMERICAN

THIS rough-torn texture is created by the use of a heavy coat of mortar with its face roughened or torn in a vertical direction.

The mortar is applied approximately $\frac{1}{4}$ inch thick, no special effort being made to remove trowel marks. (Fig. 3.) Then the surface is rough-torn by drawing the edge of a wood block up the face of the wall. A downward stroke should never be used in tearing the surface. The block should be tilted at an angle with the wall as it is drawn up. A variety of straight or wavy effects is possible.

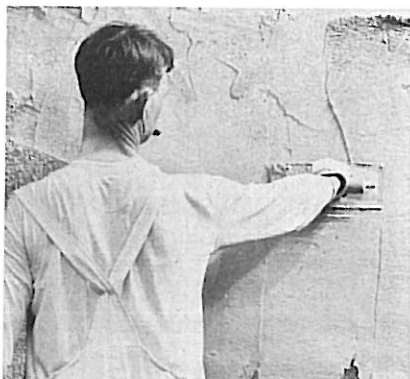
To tear the surface lightly, the board may be held in one hand; if a heavier texture is desired, both hands should be used. The different holds on the board and positions best suited to create an evenly-torn surface will come with practice.

This texture can be given an interesting tapestry effect by lightly drawing across its surface a brush dipped in a pigment of different color than that used in the mortar.





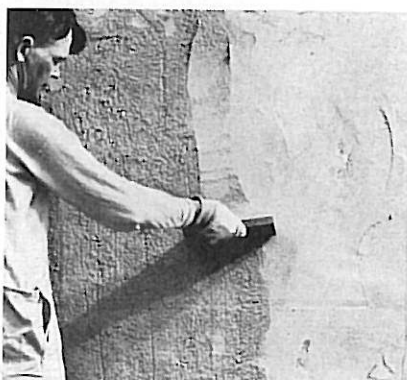
1. The covering application



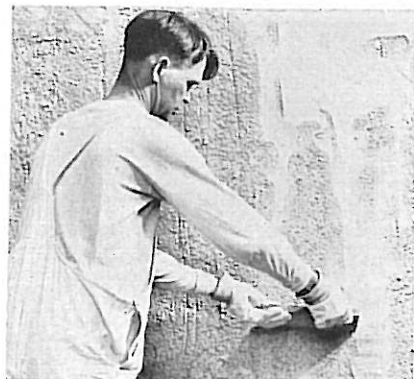
2. Full upward placing



3. Preliminary finish



4. Lightly torn surface



5. Heavily torn finish



6. A tapestry finish

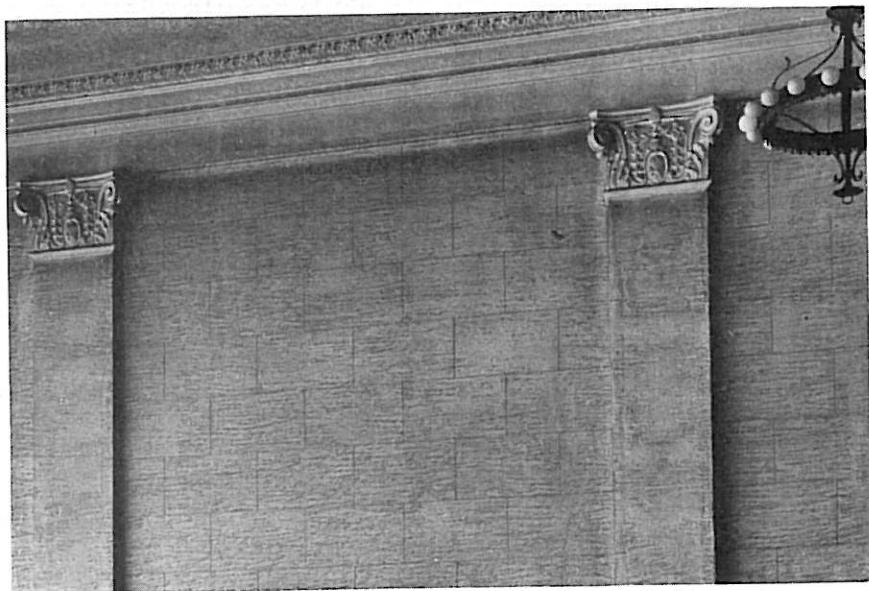
ITALIAN TRAVERTINE

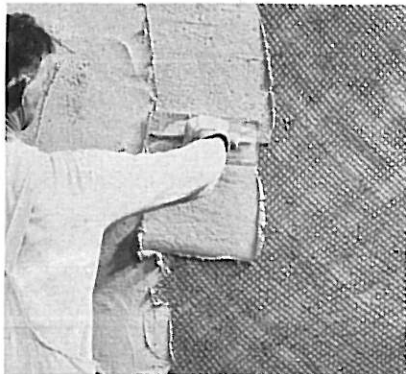
TO create this texture a very thick coat of mortar is applied and then successively stippled and troweled. To retard hardening sufficiently so that the stucco can be given these surface treatments, the brown coat must be well dampened just before the finish coat is applied. Wetting reduces the suction and consequently retards hardening.

The finish coat is applied about $\frac{3}{8}$ inch thick and troweled fairly smooth. Then its surface is stippled deeply, using a whisk broom or wire brush to pull up an irregular texture. The stippling should be irregular in appearance.

The stippled surface is later troweled while still workable to smooth out the higher portions. Depressions made by the stippling remain rough and furnish the veined effect. Greater pressure on the trowel will give finer veining.

After troweling, joints are cut in the surface with the jointing tool shown on page 25.

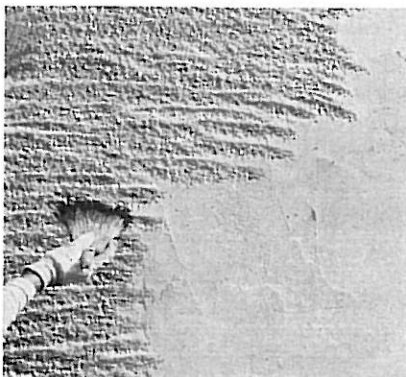




1. Heavy, strong application



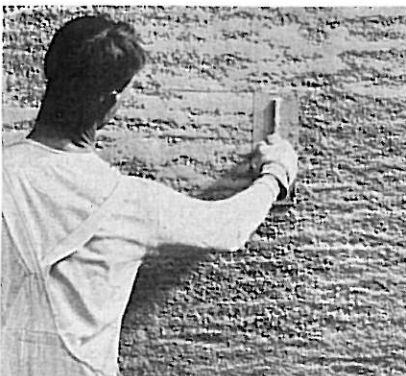
2. Irregular stippling



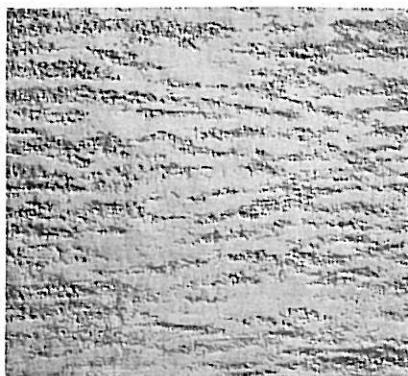
3. Brush held at an angle



4. Stippled appearance



5. Troweling horizontally



6. A stippled, troweled finish

SECTION II

PORTLAND CEMENT PLASTER

THERE is no adequate substitute for portland cement plaster as an interior finish wherever walls, partitions and ceilings are subject to rough usage or extreme moisture conditions. It is used in basements, steamrooms, vapor baths, toilet rooms, swimming pools, garages, store-rooms, trucking alleys, elevator shafts and in other places subjected to hard service.

Materials

Specifications for cement, grading and testing of aggregates, use of plasticity agents, water requirements, and the use of mineral pigments and colored cement for portland cement plaster are the same as for portland cement stucco (see pages 5 to 7). Hair or fiber used in scratch coat mortar on metal lath or wire lath should consist of first quality long hair free from foreign matter, long fiber well combed out, or a combination of both.

Bases for Portland Cement Plaster

Portland cement plaster may be applied to masonry, monolithic concrete and metal lath or wire lath bases. The application of the scratch coat differs for each type of base, but the brown and finish coats are applied in exactly the same manner regardless of the type of base.

Masonry

Concrete and clay masonry partitions and ceilings are excellent bases for the direct application of portland cement plaster. Concrete and clay furring tile and exterior masonry walls which may not require furring because they possess high insulation value are also plastered direct.

All masonry units to which plaster is applied direct should have faces sufficiently rough to provide mechanical key. Portland cement mortar should always be used in laying up masonry walls that are to receive portland cement plaster. Joints may be raked or struck off flush. The surfaces should be cleaned to remove all dust, dirt, soot, oil, paint or any other material that might interfere with satisfactory bond.



Portland cement plaster was used in turning this basement into an attractive recreation room.

Monolithic Concrete

Monolithic concrete walls and ceilings that have coarse or roughened surfaces are suitable bases for the direct application of portland cement plaster. When monolithic surfaces are not sufficiently rough or coarse to provide mechanical key for the first coat it is necessary to prepare them in one of the ways described for portland cement stucco on pages 8 to 10.

Metal Lath or Wire Lath

Metal lath or wire lath should be used as a base for portland cement plaster applied on stud partitions, furred or suspended ceilings, wall board or plaster board, gypsum furring tile and such masonry or monolithic concrete walls as require furring out with strips. Gypsum furring tile should be covered with waterproof building paper before the lath is applied.

Lath that will readily embed in the plaster is desirable and for this reason should consist of strands of wire (wire lath) or narrow strips of metal (expanded metal lath).

The lath must have sufficient weight to provide a rigid plastering surface between supports. Supports should not be spaced at greater than 16-inch intervals. Where studs or joists are placed more than 16 inches apart, furring channels or other supports are required. For the maximum spacing of 16 inches, lath weighing 3.4 pounds per square yard

will give the required rigidity. Two and one-half pound lath for walls and 3-pound lath for ceilings is often specified where supports are only 12 inches apart, although many plastering contractors in the interest of keeping fewer stocks on hand use but one weight—3.4 pound—which satisfies the requirements of different spacings up to the maximum of 16 inches. The lath should be painted, galvanized or otherwise protected against possible corrosion.

Lath may be attached directly to the faces of structural members that are less than 4 inches wide. On all faces wider than 4 inches, the lath should be furred out to permit the formation of plaster keys behind the metal. Furring strips may be wood or metal and should be securely fastened to the wall. If of metal, clearance should be provided between the wall and the strip to permit attachment of lath.

To provide a continuous network of metal over the entire area, overlapping sheets must be laced securely with galvanized wire. Sheets should be lapped at least one inch on sides and ends, and fastened on 6-inch centers to every support they cross. Annealed galvanized wire, usually of No. 18 gauge, is used to fasten the lath to metal supports and 6-penny nails or 1¼-inch staples are used on wood supports.

Suction

Suction is absolutely necessary in masonry and monolithic concrete bases and in each coat of portland cement plaster. For an understanding of suction and the methods of securing it, refer to page 13. Suction is kept uniform more easily on interior work than on exterior work, but this fact should not cause the plasterer to give less attention to its proper control when applying portland cement plaster.

Curing

Since portland cement plaster is generally exposed to severe conditions of usage, it should be given every opportunity to develop its maximum strength and density through proper curing. Methods of curing portland cement stucco as described on page 14 apply equally to portland cement plaster and should be followed carefully. Interior plaster usually dries more slowly than stucco, consequently additional time must be allowed for complete drying after the curing period. Thorough drying of each coat before applying another is absolutely essential as it guards against objectionable checking in the finished job.

Portland cement plaster should be protected against freezing during the hardening period. In enclosed buildings there is little danger of

freezing, except in the most severe weather, in which case artificial heat is desirable.

Artificial heat may be required to accelerate drying in closed buildings. In such cases a temperature of 70 degrees Fahrenheit with gentle circulation of air will produce desired results. The plaster is likely to dry too quickly if higher temperatures are maintained.



A theatre lobby, Charlotte, North Carolina. The textured walls and ceilings were developed with portland cement plaster.

Proportioning and Mixing

Proportions of materials for portland cement plaster and directions for mixing are exactly the same as for portland cement stucco as described on page 15. For scratch coat mortar on metal lath or wire lath, hair or fiber is added. Usually $\frac{1}{5}$ of a bushel per sack of cement is sufficient. In no case should more than $\frac{1}{3}$ of a bushel per sack be used.

Application

The Scratch Coat

Portland cement plaster on *masonry walls and ceilings* is applied in the same manner as portland cement stucco on masonry walls. See page 16.

The scratch coat on *monolithic concrete walls* is applied in the same manner as the scratch coat of portland cement stucco on such walls. It is dashed on, or if the wall is sufficiently rough, may be troweled on. See page 8. In order to secure tight bond on *monolithic concrete ceilings*, portland cement plaster should always be dashed on.

On *metal lath or wire lath*, the scratch coat mortar is spread with the trowel, using relatively light pressure. The hair or fiber in the mortar aids in the formation of plaster keys, holding the mortar in place.

The Brown Coat

The brown coat of portland cement plaster is applied in exactly the same manner as the brown coat of portland cement stucco. See page 17. Grounds sometimes are used as they aid in building up uniform thickness.

The Finish Coat

The brown coat must be cured and dried as described under "Curing," page 14, before the finish coat is applied. The usual finish on interior portland cement plaster is either a sand float as illustrated on page 31, or a texture of low relief similar to the one shown below.



The Sponge Swirl, a texture suitable for interior work. A troweled coat is "knocked down" with swirling motions of a sponge. Then high lights are developed by running a trowel over the surface.

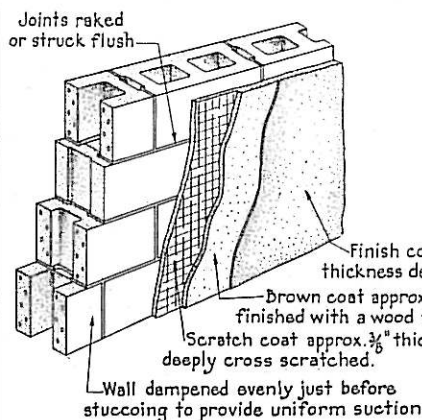
If a smooth troweled finish is desired, late troweling is required. The steel trowel forces sand particles down into the plaster, compacting the mass and leaving the surface smooth. Moist curing for at least 7 days is recommended to avoid checking, particularly on hard troweled finishes.

Painting

Portland cement plaster may be painted with either oil or water paints. If water paint is to be used, manufacturers' instructions should be followed.

If oil paint is to be used the surface should be allowed to dry thoroughly. Then it should be covered with a solution of zinc-sulphate mixed in the proportions of 2 or 3 pounds of crystals to a gallon of water. The surface then must be allowed to dry 48 hours, after which any remaining zinc-sulphate crystals are brushed off. Under no condition should the solution be applied before the wall is completely dry. After the application of the zinc-sulphate wash, the walls should be sized with oil or varnish, after which the surface is ready for oil paint or other decorative finish.

SECTION III CONSTRUCTION DETAILS



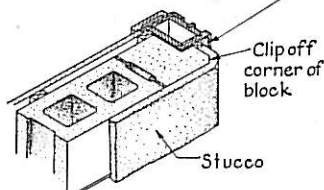
CONCRETE TILE OR BLOCK WALL

Lintels should have coarse texture or be roughened to secure adequate bond

Soffit sloped outward to provide drip—brick mold placed after stucco is applied

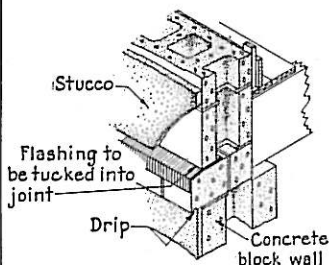
DETAIL OF WINDOW HEAD

Brick mold placed after stucco is applied

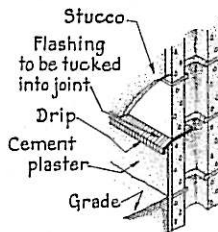


DETAIL OF WINDOW JAMB

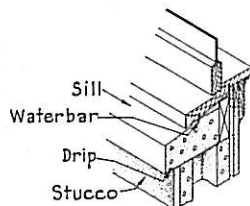
Note:—Drip on belt courses, sills etc. must project clear of stucco.



DETAIL OF FLASHING
WATER TABLE OR BELT COURSE

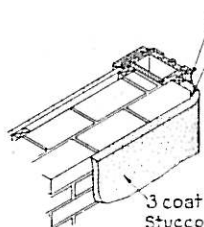
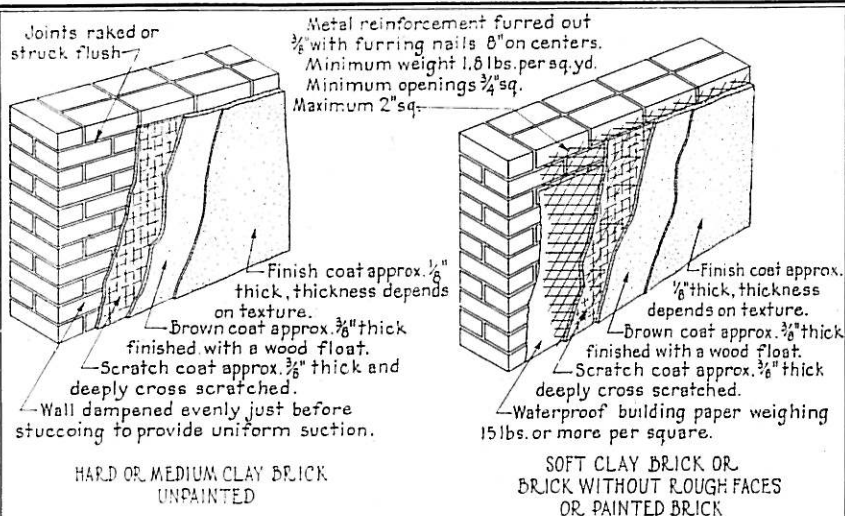


METHOD OF STOPPING
STUCCO WHERE NO BELT COURSE
OR SOLDIER COURSE IS PROVIDED

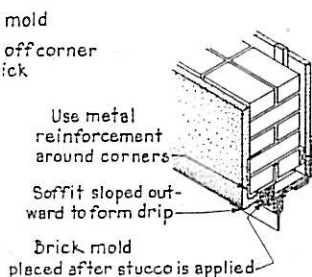


DETAIL OF WINDOW SILL

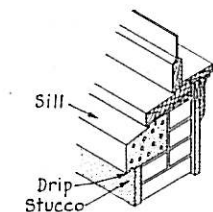
STUCCO ON CONCRETE MASONRY



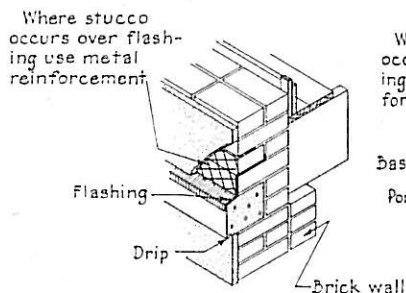
DETAIL OF WINDOW JAMB



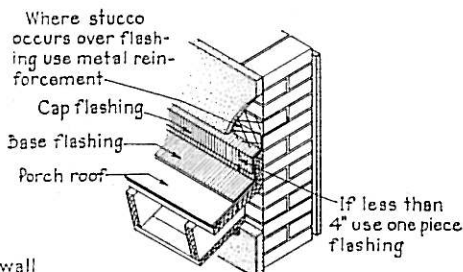
DETAIL OF WINDOW HEAD



DETAIL OF WINDOW SILL



DETAIL OF FLASHING WATER-TABLE OR BELT COURSE



DETAILS OF FLASHING WHERE PORCH ROOF ABUTS BRICK WALL

STUCCO ON BRICK

Metal reinforcement furred out $\frac{3}{8}$ " with furring nails 8" on centers.
Minimum weight 1.8 lbs. per sq. yd.
Minimum opening $\frac{1}{4}$ " sq. Maximum 2 sq.

Waterproof building paper, weighing 15 lbs. or more per square applied over old siding.

Metal reinforcement must extend down over flashing.

New flashing

Drip cap built out and new moulding provided.

Finish coat approx. $\frac{1}{8}$ " thick, thickness depends on texture.

Brown coat approx. $\frac{1}{8}$ " thick, finished with a wood float.

Scratch coat approx. $\frac{3}{8}$ " thick, deeply cross scratched.

Loose siding must be renailed securely.

OVERCOATING ON OLD WOOD CONSTRUCTION

DETAIL OF WINDOW HEAD

Waterproof building paper weighing 15 lbs. or more per square applied over old siding.

Old casing

New stucco mold

Metal reinforcement

Waterproof building paper weighing 15 lbs or more per square applied over old siding.

Metal reinforcement must extend down over flashing.

New flashing

Foundation

DETAIL OF WATER TABLE

DETAIL OF WINDOW JAMB

Old sill

Drip

Flashing

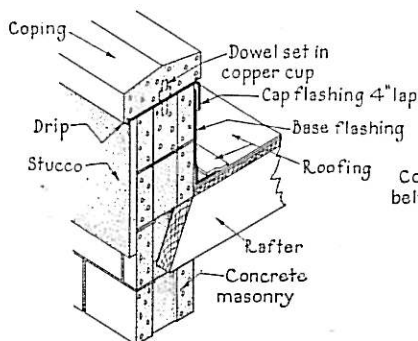
Metal reinforcement

Stucco

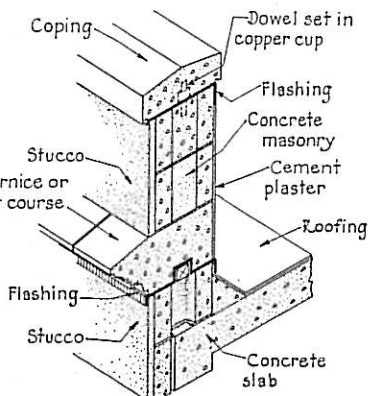
Waterproof building paper weighing 15 lbs. or more per square applied over old siding.

DETAIL OF WINDOW SILL

STUCCO OVERCOATING ON WOOD FRAME

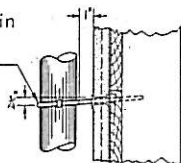


DETAIL OF FLASHING
COPING AND PARAPET WALL
LESS THAN 24" HIGH

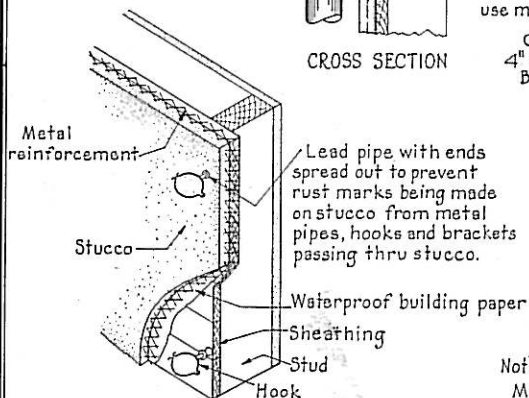


DETAIL OF FLASHING FOR
CORNICE, COPING AND PARAPET
WALL HIGHER THAN 24"

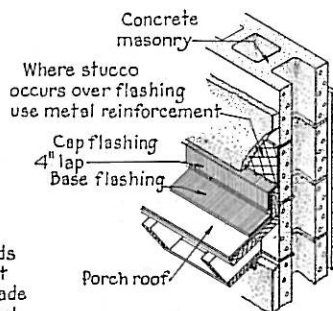
Hook sloped down to drain
water away from wall to
eliminate rust marks



CROSS SECTION



DETAIL OF FLASHING FOR
DOWNSPOUT HOOK

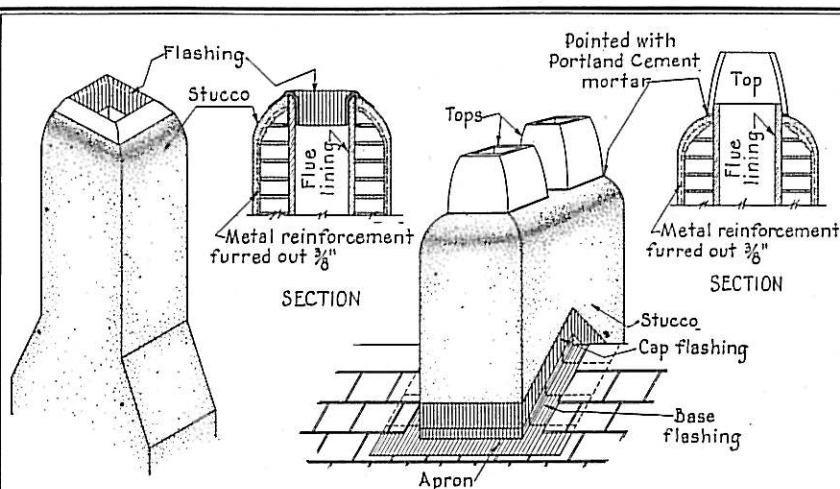


DETAILS OF FLASHING
WHERE PORCH ROOF ABUTS
CONCRETE MASONRY WALL

Note:-

Metal reinforcement
furred out $\frac{3}{8}$ " with furring
nails 8" on centers.
Minimum weight 1.8
lbs. per square yard.
Minimum openings
 $\frac{3}{4}$ " sq. Maximum 2" sq.

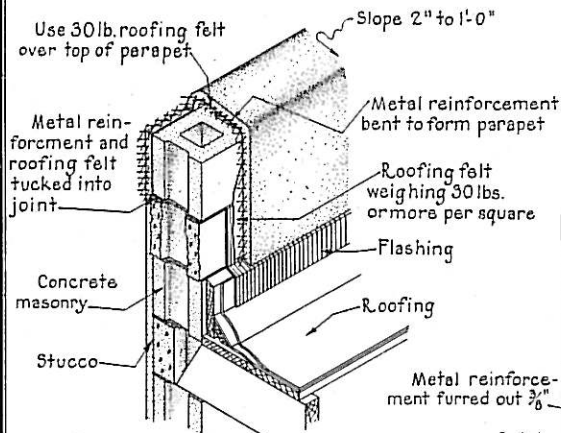
MISCELLANEOUS FLASHING DETAILS



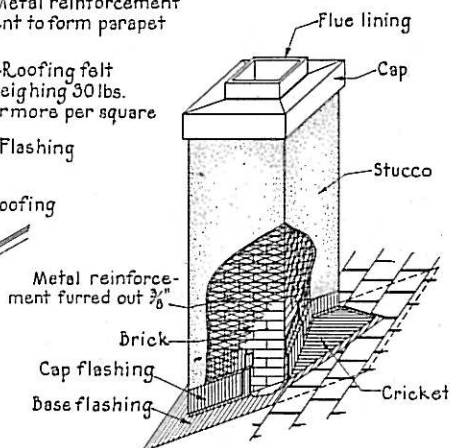
DETAIL OF SPANISH TYPE CHIMNEY WITHOUT TOP

DETAIL OF SPANISH TYPE CHIMNEY WITH TOPS

Note:-
 Metal reinforcement furred out $\frac{3}{8}$ " with furring nails 8" on centers.
 Minimum weight 1.8 lbs per square yard.
 Minimum openings $\frac{1}{4}$ " square. Maximum 2" sq.

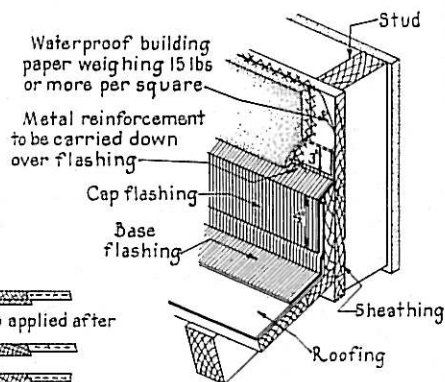
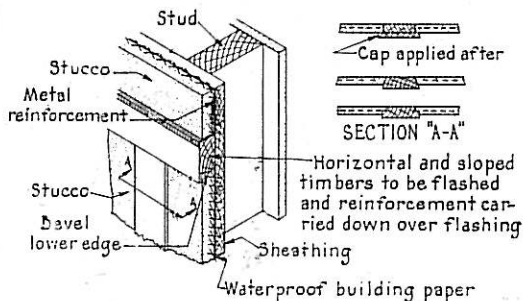
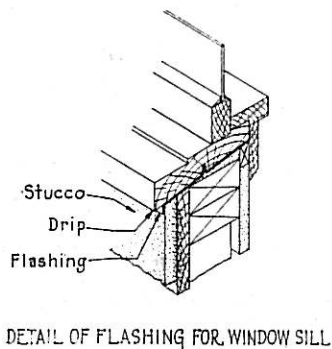
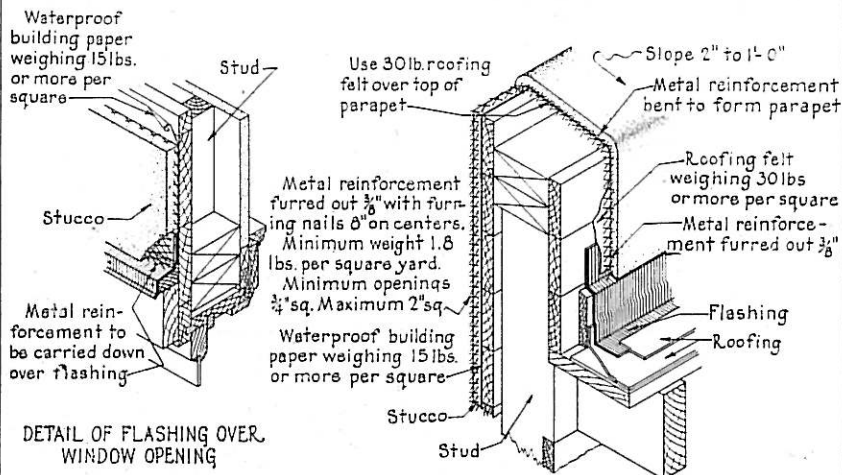


DETAIL OF FLASHING ON CONCRETE MASONRY PARAPET WALLS



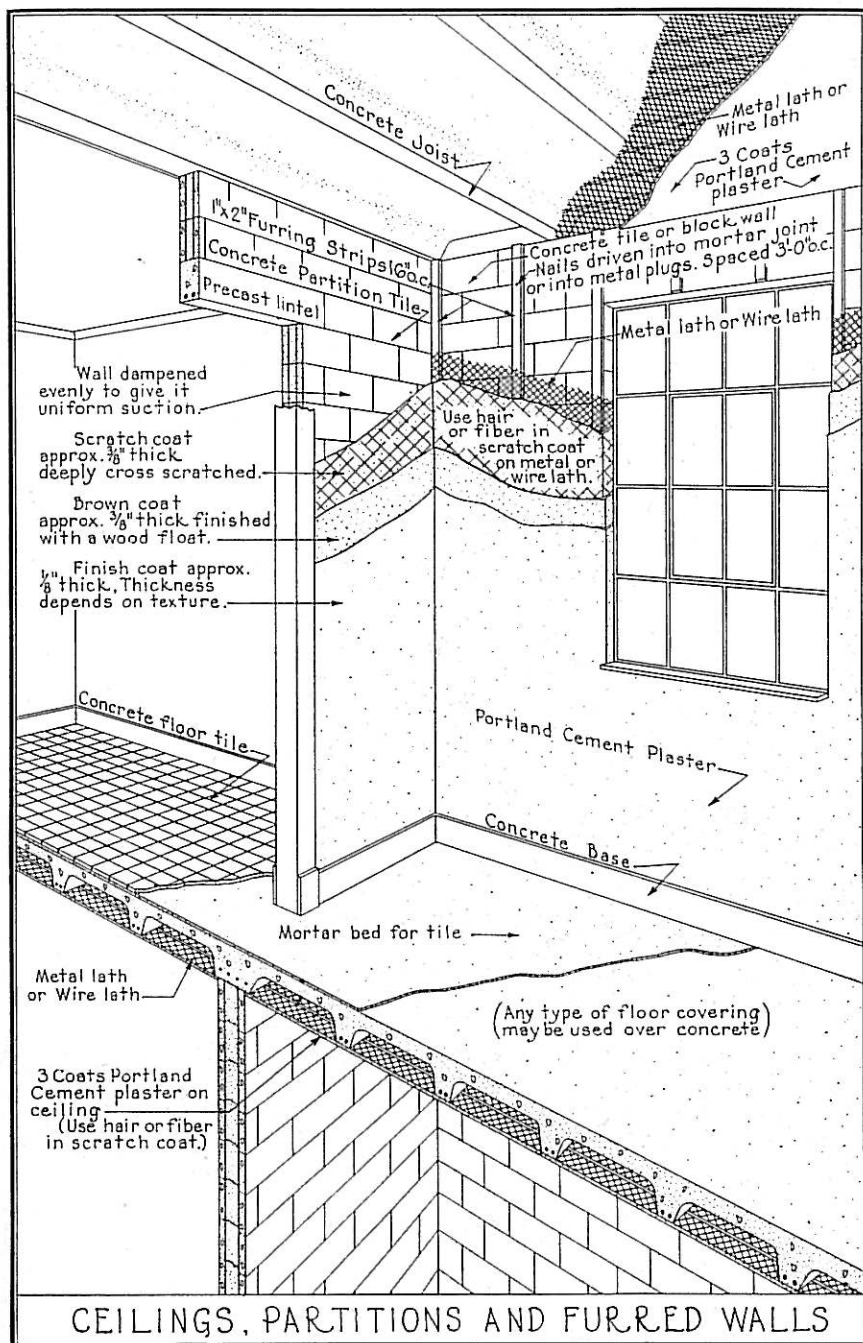
DETAIL OF FLASHING AROUND CHIMNEY

FLASHING DETAILS CHIMNEY AND ROOF



FLASHING FOR HALF-TIMBER CONSTRUCTION

FLASHING FOR STUCCO ON WOOD FRAME



PORTLAND CEMENT ASSOCIATION

A National Organization to Improve and Extend the Uses of Concrete

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